



## TOWBOAT MANEUVERING SIMULATOR VOLUME I - USERS GUIDE

PETER VAN DYKE



MAY 1979

Document is available to the public through the National Technical Information Service, Springfield, Virginia 22151

Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
United States Coast Guard
Office of Research and Development
Washington, D.C. 20690

DTIC ELECTE JUN 28 1982

82 06 28 010

THE COPY

80.70

### NOTICE

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

The contents of this report do not necessarily reflect the official view or policy of the Coest Guard; and they do not constitute a standard, specification, or regulation.

This report, or portions thereof may not be used for advertising or sales promotion purposes. Citation of trade names and manufacturers does not constitute endorsement or approval of such products.

	Ì	2.5	e11	,	<b>333</b>		**		inn				
	2	<b>\$</b> }	11i			•	III.					3	2
riess tree Motel	Manual IV		1223	ANEA	3222 2222	MASS (unight)	<b>3</b> 23	VOLUME	825 <b>3</b> 2	TEMPERATURE found		\$ \$-	2
Appresiment Constraints from 1	Mes Yes Less		H			7						3 - 0	-
_	į	1	i e e S		t (rf		•3•		` 1Y	i	,	*	7 63
		ez ei						MALLINE					1
1777			-  -  -	  asla	      	ויןין.   	ririch.	֓֞֟֓֓֟֟֓֟֓֟֟֟֟֓֟֟֟֟֟֟֟֟ ֓֞֓֓֓֞֓֓֓֞֓֓֓֞֓֓		"""""  -			inches
	To Find						ılı				1		sebra, see 1666 Shee, Fast, 269,
	*	LEBOTIO	3,33	ABEA	<b>333</b> 33		,33	VOLDER	.,,335	TEMPLEATURE forms	3	i.	D Coming No. Chile A
Agendan Co		ļ	isti					,	Hini			i	une o 226 septem. As also sens presenta sed mes deben une d'engges sed lessent, fres 16.36, 20 Counq in. Cl. 1923
,	j		4e\$1	]	3533		14		ill.ss	<b>133</b>	•	,	12:22

Copy available to Dric does not Pennit fully legible reproduction.

### Technical Report Documentation Page

1. Report No.	<u></u>	2. Government Acces	sien Ne. 3.	Recipient's Cetalog	No.
CG-D-61-79		18-1111	163		
4. Title and Subtitle		12 /1/10	5.	Report Date	<del></del>
Towboat Ma	neuvering Simula	ator		May 1979	
1	Users Guide		6.	Performing Organizat	ion Code
			8.	Performing Organizati	on Report No.
7. Author's) Peter Van	Dyke			7909-1	
	ization Name and Address		10	Werk Unit No. (TRA	is)
Hydronauti Laurel. Ma			11	DOT-CG-840165	S-A
			13	Type of Report and I	Period Covered
	cy Name and Address			Final Report	
	rtment of Trans	portation		Sep 1978 - Ma	ay 1979
	tes Coast Guard		114		·
	Research and Dev	veropment	"	Sponsoring Agency C G-DSA-1	.040
15. Supplementary N	, D. C. 20590				<del></del>
	Coast Guard's to	echnical repre	esentative for th	e work describ	oed herein
16. Abstract	·				
of the hyd program ru graphic an real time, and immedi	rodynamic responding continuous deviced hard copy deviced interactive sinately updating volume describes	nse of an inte sly on a compu ices attached mulator, const the console di s the use of t	consists of a mategrated river town ter, with a cont for input and out antly responding splays.  The simulator, pre input and outp	embodied in a rol console ar tput. It is to to console	a computer nd other thus a ommands
17. Key Words			18. Distribution Statement		
Towboat			Document is av	ailable throu	gh the
Maneuverin	g		National Techn Springfield. V	ical Informat <sup>i</sup>	
19. Security Classif	(of this report)	20. Security Clear	nif. (of this page)	21- No. of Pages	22. Price
Unclassifi					
		<del></del>			<del></del>

Form DOT F 1700.7 (8-72)

Reproduction of completed page authorized

L

### TABLE OF CONTENTS

		Page
1.0	GENERAL DESCRIPTION	1
2.0	CONSOLE DESIGN	5
3.0	SIMULATOR INPUTS	9
4.0	SIMULATOR OUTPUTS	12
5.0	CONSOLE CONNECTIONS	21
6.0	SIMULATOR OPERATION	24
7.0	WIRING DIAGRAMS	27
8.0	SCENARIO PARAMETERS	30

Accession For	4
NTIS GRA&I DTIC TAB Unenneumoed Justification	\ 
By	
Avgil and/or Dist   Special	
H	

### HYDRONAUTICS, Incorporated

### -ii-

				Page
Figure	1	-	Simulator Problems	. 2
Figure	2	-	Simulator Hardware	, 3
Figure	3	-	Computer Program Flow	. 4
Figure	4	-	Towboat Console	6
Figure			Simulator Console	
Figure	6	_	Similator Console	. 8
Figure	7	_	Sample Inputs	. 10
Figure	8	-	Computer Program Inputs and Outputs	. 11
Figure	9	-	Printer Output	. 13
Figure	10	_	Berwick Bay, Louisiana Chart	. 14
Figure	11	_	Operator Strategy	. 15
Figure	12	-	Berwick Bay Passage	. 16
Figure	13	-	Current Map	. 17
Figure	14	_	No Current	. 18
Figure	15	_	Upstream and Bridge Currents	. 19
Figure	16	-	Upstream and Bridge Currents	. 20
Figure	17	-	Wiring Diagram 1	28
			Wiring Diagram 2	

### TOWBOAT MANEUVERING SIMULATOR USER'S GUIDE

### 1.0 GENERAL DESCRIPTION

The Towboat Maneuvering Simulator consists of a mathematical description of the hydrodynamic response of an integrated river tow embodied in a computer program running continuously on a computer, with a control console and other graphic and hard copy devices attached for input and output. It is thus a real time, interactive simulator, constantly responding to console commands and immediately updating the console displays. Figure 1 illustrates the cumulative relative cost of a typical simulator as more operator-specific equipment is added to the basic mathematical model. The three order-of-magnitude increase in cost is a result of the image projection equipment required to provide visual displays. Typical problems which can be run are also shown in this figure.

Figure 2 shows the components of the simulator. All of the components except the console were supplied by the U.S. Coast Guard, and the console was designed and constructed by HYDRONAUTICS, Incorporated.

The logic flow of the computer program is illustrated in Figure 3. The programs are described in detail in Volume II of this report.

# COMPUTER VISUAL/RADAR IMAGE PROJECTION PLOTTER CONSOLE COMPLETE WHEELHOUSE 10 1000 10000

ENVIRONMENTAL - WIND, WAVES, CURRENT
SHIP CHARACTERISTICS - DESIGN ANALYSIS, BOW THRUSTER
CHANNEL / PORT CONFIGURATION - BRIDGES, LIGHTS, MOORINGS
EMERGENCY MANEUVERS
EQUIPTMENT FAILURE

FIGURE 1 - SIMULATOR PROBLEMS

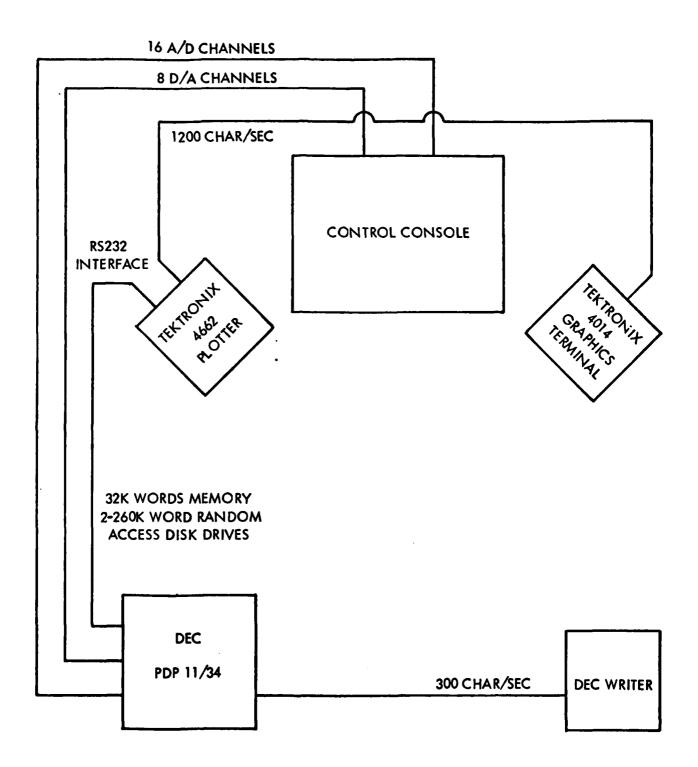


FIGURE 2 - SIMULATOR HARDWARE

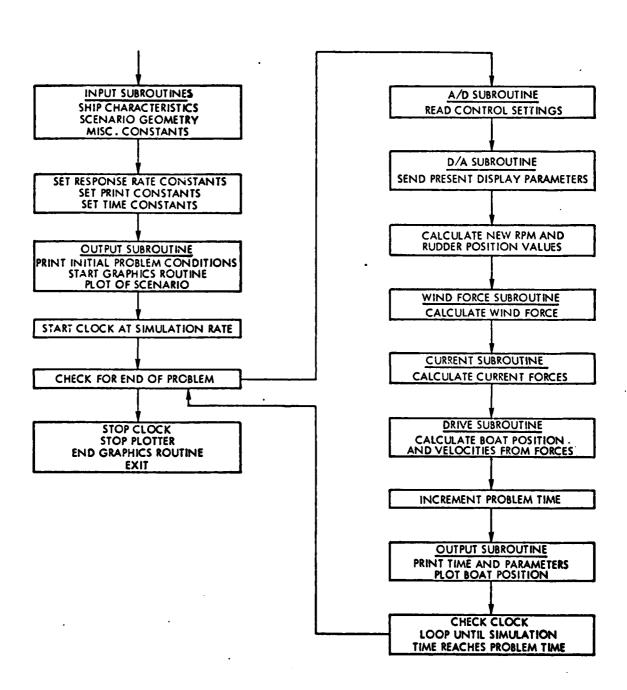


FIGURE 3 - COMPUTER PROGRAM FLOW

### 2.0 CONSOLE DESIGN

The console design was based on the console in a towboat built by Dravo Corporation. Drawings for the console and the control handles were supplied by Dravo to HYDRONAUTICS to assist in our design. Figure 4 is a picture of the actual console on which our design is based; Figures 5 and 6 show the layout and overall dimensions.

### HYDRONAUTICS, INCORPORATED



FIGURE 4 - TOWBOAT CONSOLE

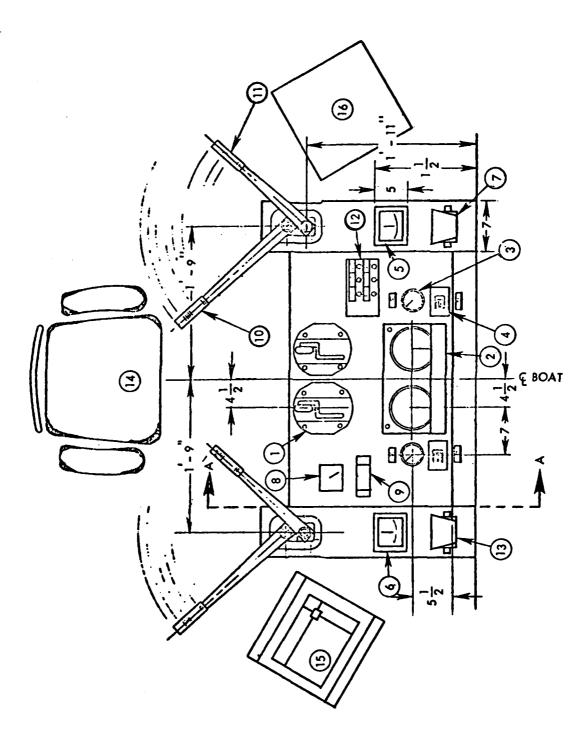


FIGURE 5 - SIMULATOR CONSOLE

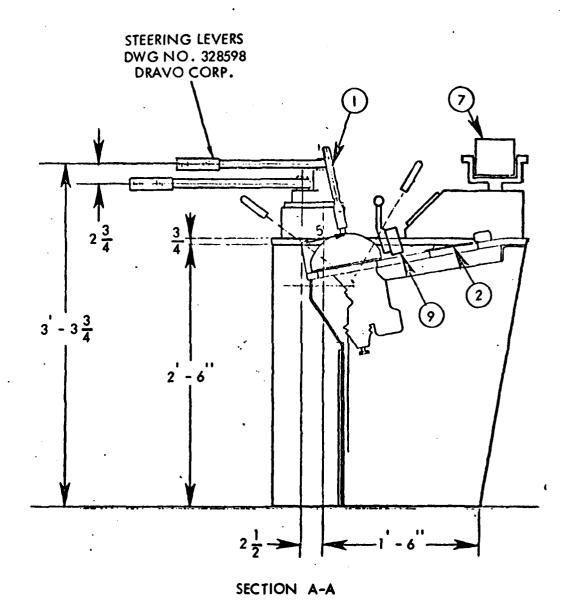


FIGURE 6 - SIMULATOR CONSOLE .

### 3.0 SIMULATOR INPUTS

Input data on initial conditions, ship characteristics, and scenario definition come into the problem through the three input subroutines. These are described in Volume II of this report. Figure 7 illustrates typical initial conditions, ship, and scenario definitions which can be combined to produce a specific problem. For example, using DTQ03, DTR31, and DTS01 we would have the EXXON NASHVILLE in the Berwick Bay Bridge Scenario, moving up-river with the simulation at twice real time. The scenario input routine contains the waterway geometry, current, and wind conditions. ship routine contains all coefficients and parameters for the tow to be used. The initial condition routine describes initial position, speed, rpm and rudder settings, and time constants for the tow in the scenario. The ship, current, and wind data necessary for these routines is described in Volume III of this report. Figure 8 lists the other inputs and outputs; the inputs all come from the console and are as numbered in Figure 5:

Port RPM Ordered	Figure 5 - 1 left
Starboard RPM Ordered	1 right
Steering Rudder Ordered	10
Flanking Rudder Ordered	11
Bow Thruster RPM Ordered	9
Stop Switch	12

Section 8, Scenario Parameters, provides specific descriptions of many of the variables in the input routines which are used to set up the operating geometry.

### HYDRONAUTICS, INCORPORATED

ITHIS COMMOND FILE LISTS THE EXAMPLES WHICH MAY BE RUN IBY COPYING THE FILE DIGXX.FOR TO DILLO.FOR, COMPILING IDILIO, AND RUNNING THE COMMOND FILE MATIO.COM

!		
!	XX	DESCRIPTION OF INITIALIZATION FILE
!	01	BERWICK BAY BRIDGE DOWNRIVER (2 X T)
į	02	BERWICK BAY BRIDGE DOWNRIVER
!	03	BERWICK BAY BRIDGE UPRIVER (2 X T)
!!!	04	BERWICK BAY BRIDGE UPRIVER
į	21	TANKER MANEUVERING IN FORT
	22	TANKER MANEUVERING IN PORT (4 X T)
i	31	WILKINSON POINT DOWNRIVER (2 X T)
; 		WILKINSON POINT UPRIVER (2 X T)
	52 54	- The state of the
ı		31 14 14 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1
		OMMANO FILE LISTS THE EXAMPLES WHICH MAY BE RUN
		YING THE FILE DTRXX.FOR TO DTM10.FOR. COMPILING
	HIM10,	AND RUNNING THE COMMAND FILE MATIO.COM
-:		
ı	XX	DESCRIPTION OF SHIP FILE
i		A CHARACTER AND THE STORY STORY STORY OF A MARKET STORY
ļ	01	EXXON TENNESSEE
ļ		
ļ	· :	
!		TWIN SCREW TANKER
'	22	SINGLE SCREW TANKER
:	31	EXXON NASHVILLE
į		CONTROL OF THE PROPERTY OF THE
	THIS C	DMMAND FILE LISTS THE EXAMPLES WHICH MAY BE RUN
		YING THE FILE DISXX.FOR TO DIN10.FOR, COMPILING
		AND RUNNING THE COMMAND FILE MATIO.COM
į		
!		
		DESCRIPTION OF SCENARIO
•	01	BEDUTOV DAY DOTOCE
-	02	BERWICK BAY BRIDGE NO CURRENT
:	VÆ	INDUNDS ON TOTAL OR THE UPTAINS
į		
1	21	DEEPWATER PORT
ļ		
!		
1	31	WILKINSON POINT
:	32	WILKINSON POINT NO CURRENT

Copy available to DTIC does not permit fully legible reproduction./
FIGURE 7 - SAMPLE INPUTS

### A/D INPUTS

PORT PROP RPM ORDERED
STBD PROP RPM ORDERED
STEERING RUDDER ORDERED
FLANKING RUDDER ORDERED
BOW THRUSTER RPM ORDERED
STOP SWITCH

### D/A OUTPUTS

PORT PROP RPM
STBD PROP RPM
STEERING RUDDER ANGLE
FLANKING RUDDER ANGLE
BOW THRUSTER RPM
RATE OF TURN
HEADING ANGLE

### PRINTER OUTPUT

TIME X,Y POSITION
RPM PORT, RPM STBD, THRUSTER RPM
SPEED OVER BOTTOM
HEADING, TURNING RATE
STEERING RUDDER, FLANKINGRUDDER ANGLES
SIDESLIP ANGLE RELATIVE TO BOTTOM

### **GRAPHIC OUTPUT**

PLOTTER - SCENARIO, 30 SEC POSITION SCREEN - SCENARIO, 10 SEC POSITION

### 4.0 SIMULATOR OUTPUTS

The simulator outputs are given in Figure 8. The console outputs are numbered in Figure 5 as follows:

Port Propeller RPM	Figure 5 - 2 left
Starboard Propeller RPM	2 right
Steering Rudder Angle	5
Flanking Rudder Angle	6
Bow Thruster RPM	. 8
Rate of Trun	13
Heading Angle	7

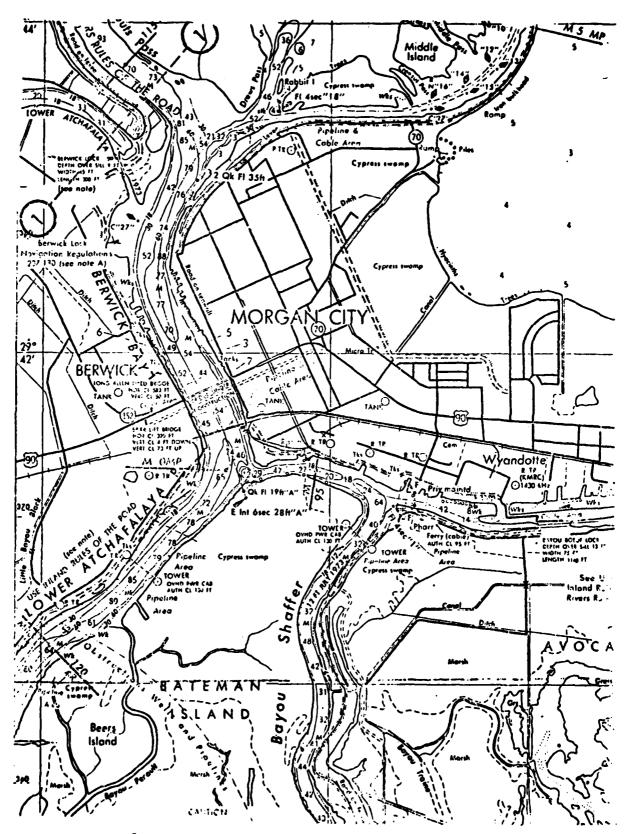
Printer Output is illustrated in Figure 9.

The Berwick Bay Bridge problem is described in Figures 10 through 12. The scenario geometry and current specification scheme for this problem is illustrated in Figure 13. A series of 30 stations at Position X, Y with length R at angle  $\alpha$  are specified, and the currents at 8 evenly spaced positions at each station are specified by velocity  $V_c$  and direction  $\chi_c$ . The figure shows the positions of the 30 stations. The current values and directions are as given in Volume II, in the listing of DTN10.

Graphic Output is illustrated in Figures 14 through 16. The only difference between the plotter and screen output is the frequency of boat position, as selected by the program.

THE(H.H.S.) X  V RPH F RPH S SPEED HEADING GATE RUDGE SETTINGS ELTA TRPH  0.0.0 1 14355  0.0.0 1 14355  0.0.0 1 14355  0.0.0 100.00 100	01-BI	-BERWICK B	BAY PRIDGE	DOWNRIVER	R (2 X T)		SAMPLE	RUN NUMBER	ER 2		30-MAR-79	R-79
HECH H. 5) X Y RPH F RPH G SPEED HEADING RATE KUUDER SETTINGS BETA CO. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.												
0. 0. 0 14355, 3350, 100.00 0 7.00 216.00 0 0.00 0 0.0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0	HE(H.M.	×		RPM P	RPM S	ш	_		UDE	ETTIN	S RET	TRPM
0.40         14158         3156         130.47         130.37         7.39         215.44         0.050         5.2         0.1         355.57           0.40         13734         2652         130.47         130.37         7.39         215.44         0.050         5.2         0.1         357.79           1.0         13734         2652         130.47         130.37         8.26         209.87         0.012         5.9         0.1         357.72           1.20         13737         2666         130.47         130.37         8.26         209.87         0.127         5.9         0.1         357.72           2.0         13025         2391         130.47         130.37         8.76         0.127         5.9         0.1         357.72           2.0         13025         130.47         130.37         8.73         197.71         0.113         2.7         0.1         355.73           3.0         120.40         130.57         130.37         8.83         197.71         0.113         2.5         0.1         355.43           3.0         120.40         130.57         130.47         8.87         197.05         0.113         357.73           3.0 <th>0.0.0</th> <th>14355</th> <th>•</th> <th>100.00</th> <th>•</th> <th>0</th> <th></th> <th>•</th> <th>i •</th> <th>0.0</th> <th>•</th> <th></th>	0.0.0	14355	•	100.00	•	0		•	i •	0.0	•	
0.40         13734         20.65         130.57         130.47         7.73         214.09         -0.062         5.9         0.1         355.75           1.20         13504         2557         130.47         130.47         20.0         20.0         20.0         25.7         0.1         357.75           1.20         13507         2566         130.47         130.37         8.46         20.73         -0.127         5.9         0.1         355.77           2.20         12075         2591         130.47         130.37         8.46         20.73         -0.137         3.7         0.1         355.7           2.20         12770         2246         130.57         130.47         8.71         200.0         0.135.7         3.70         0.1         355.7           2.40         12059         208         130.47         8.71         200.0         0.115.2         5.70         0.1         355.40           3.20         11406         130.57         130.47         8.87         197.4         0.1         357.40           3.20         11406         130.57         130.47         8.87         197.4         0.115         0.1         357.40           4.20<	0.12	4158	u-1	130.47	•	113	•	•	•	0.1	39.	•
1.0 13734. 2852. 130.57 130.27 8.01 212.17 -0.110 7.6 0.1 357.79 1.40 13274. 28652. 130.47 130.37 8.46 207.39 -0.120 5.9 0.1 357.72 1.40 13275. 2842. 130.47 130.37 8.46 207.39 -0.120 5.9 0.1 355.72 2.0 13025. 2391. 130.47 130.37 8.41 204.76 -0.131 3.7 0.1 355.72 2.0 13025. 2391. 130.47 130.37 8.41 204.76 -0.131 3.7 0.1 355.74 2.0 12509. 2108. 130.57 130.37 8.78 170.0113 2.5 0.1 355.40 2.0 12509. 2108. 130.57 130.37 8.83 197.71 -0.113 2.5 0.1 355.40 3.0 12241. 1978. 130.57 130.47 8.83 197.71 -0.113 2.5 0.1 355.40 4.0 11406. 1646. 130.57 130.47 8.89 193.41 -0.092 0.4 0.1 354.04 4.0 11406. 1646. 130.57 130.47 8.82 187.62 -0.194 8.1 0.1 353.63 3.0 10543. 1437. 130.57 130.47 8.62 177.61 -0.130 10.1 352.04 4.0 10832. 1488. 130.57 130.47 8.61 146.30 -0.181 10.1 352.04 5.0 10544. 1410. 130.57 130.47 8.61 166.30 -0.181 10.1 350.77 5.0 10543. 1417. 130.57 130.47 8.61 166.30 -0.181 10.1 350.77 5.0 10544. 1410. 130.57 130.47 8.61 166.30 -0.181 10.1 350.79 5.0 10542. 1446. 130.57 130.47 8.61 146.30 -0.181 10.1 350.79 5.0 10542. 1446. 130.57 130.47 8.61 164.30 -0.180 10.2 0.1 350.49 5.0 10543. 1417. 1560. 130.57 130.47 8.51 145.30 -0.194 8.7 0.1 350.49 5.0 10543. 1417. 1560. 130.57 130.47 8.51 145.30 -0.194 8.7 0.1 351.63 5.0 10543. 1447. 130.57 130.47 8.52 1443.14 -0.106.9 0.5 0.1 351.67 5.0 10543. 1445. 130.57 130.47 8.52 145.30 -0.195 0.5 0.1 351.67 5.0 10542. 1448. 130.57 130.47 8.52 145.30 0.108 -0.704 0.1 351.67 5.0 10542. 1448. 130.57 130.47 8.52 145.30 0.108 -0.704 0.1 351.67 5.0 10542. 1448. 130.57 130.47 8.52 148.49 0.108 -0.704 0.1 351.67 5.0 10542. 1448. 130.57 130.47 8.52 148.49 0.108 -0.007 0.1 351.67 5.0 10542. 1448. 130.57 130.47 8.52 148.49 0.108 -0.007 0.1 351.67 5.0 10542. 1448. 130.57 130.47 8.52 148.79 0.108 -0.007 0.1 351.67 5.0 10542. 1448. 130.57 130.47 8.52 148.79 0.108 -0.007 0.1 351.67 5.0 10542. 1448. 130.57 130.47 8.52 148.79 0.108 -0.007 0.1 351.67 5.0 10540. 1449. 1440.	. 0.4	3951	•	130.57	130.47	Č		•	•	0.1	356.55	.01
1.20         13507.         2696.         130.47         130.37         8.26         209.88         -0.120         5.9         0.1         357.22           1.40         13271.         2542.         130.47         130.37         8.44         204.76         -0.137         3.7         0.1         355.7           2.20         13270.         2246.         130.57         130.37         8.71         204.76         -0.117         3.7         0.1         355.78           2.20         1270.         2246.         130.57         130.37         8.81         10.117         3.7         0.1         355.14           3.20         1250.         2108.         130.57         130.37         8.82         197.71         -0.113         2.5         0.1         357.46           3.20         11968.         196.         130.47         8.87         195.46         -0.113         2.5         0.1         357.40           3.20         11689.         1746.         130.67         130.47         8.89         197.41         0.113         2.5         0.1         357.43           4.0         1120.         1559.         130.47         8.89         187.54         0.113         357.64	1:	3734	117	130.57	130.27	ç	•		ì •	0:1	357.79	-0.01709
1.40         13271.         2542.         130.47         130.37         8.46         207.39         -0.127         5.9         0.1         355.79           2.0         13025.         2391.         130.47         130.37         8.41         204.76         -0.131         3.7         0.1         355.97           2.0         1270.         2246.         130.57         130.37         8.78         200.00         -0.115         3.7         0.1         355.41           3.0         12509.         2108.         130.57         130.37         8.87         197.71         -0.113         2.5         0.1         355.44           3.20         11808.         1746.         130.57         130.47         8.87         197.71         -0.113         2.5         0.1         355.40           3.40         11606.         130.57         130.47         8.87         197.71         -0.113         2.5         0.1         355.64           4.20         1189.         17.46         130.57         130.47         8.73         187.81         0.1         355.64           5.0         10.0         130.47         8.62         17.81         -0.194         8.1         0.1         355.67	. 1.2	3507	п.	130.47	130.37	N	•	•		0.1	357.22	-0.01709
2.0         13025.         2391.         130.47         130.37         8.61         204.76         -0.131         3.7         0.1         355.97           2.20         12770.         2246.         130.57         130.47         8.71         202.31         -0.117         3.7         0.1         355.80           2.20         12509.         2108.         130.57         130.47         8.83         197.71         -0.113         2.6         0.1         355.46           3.20         1168e.         1857.         130.57         130.47         8.87         197.71         -0.113         2.6         0.1         355.46           3.40         1168e.         1857.         130.57         130.47         8.87         197.05         -0.101         0.1         353.64           4.0         1140b.         130.57         130.47         8.82         187.52         -0.194         8.1         0.1         353.64           5.0         10832         1410         130.57         130.47         8.62         177.61         0.305         18.60         16.2         0.194         18.1         0.1         353.64         18.2         0.0         0.0         130.7         0.1         353.64	1.4	3271	•	130.47	130.37	4	•	-0.127	•	0.1	356.73	-0.01709
2.20         12770.         2246.         130.57         130.47         8.71         202.31         -0.117         3.7         0.1         355.80           3.40         12599.         2109.         130.57         130.47         8.78         200.00         -0.115         3.7         0.1         355.46           3.20         1968.         1876.         130.57         130.47         8.87         197.41         -0.092         0.4         0.1         353.63           3.20         11968.         1876.         130.57         130.47         8.89         193.41         -0.092         0.4         0.1         353.63           3.40         11689.         1746.         130.57         130.47         8.89         193.41         -0.092         0.4         0.1         353.63           4.0         11406.         130.57         130.47         8.73         187.51         0.1         353.63           5.0         10532.         1440.         130.57         130.47         8.61         164.64         0.156.7         0.1         353.63           5.0         954.         1417.         130.57         130.47         8.61         164.64         0.156.87         0.1         353	гі 	3025	11	130.47	130.37	9		-0.131	ì •	0.1	355.97	-0.01709
2.40         12509.         2108.         130.57         130.37         8.78         200.00         -0.115         3.7         0.1         355.46           3.0         12241.         1978.         130.57         130.37         8.78         197.71         -0.113         2.6         0.1         355.46           3.0         12641.         1978.         130.57         130.47         8.89         197.41         -0.113         2.6         0.1         353.45           4.0         11406.         1646.         130.57         130.47         8.87         191.05         -0.113         2.6         0.1         353.63           4.0         11406.         1646.         130.57         130.47         8.87         191.05         -0.163         8.1         0.1         353.63           5.0         10543.         1430.         130.57         130.37         8.62         177.61         -0.166         0.0         0.1         353.63           5.0         1054.         140.         130.57         130.37         8.61         166.30         -0.186         8.7         0.1         351.63           5.0         9.44         144.         130.57         130.47         8.61		2770	•	130.57	130.47	Ņ		-0.117	•	0.1	355.80	-0.01709
3.0         12241.         1978.         130.57         130.47         8.83         197.71         -0.113         2.6         0.1         355.46         35.46         35.47         35.44         -0.111         2.5         0.1         354.04         35.40         1466.         130.57         130.47         8.87         197.74         -0.111         2.5         0.1         354.04         4.0         130.57         130.57         130.47         8.87         197.75         -0.194         8.1         0.1         352.64         4.0         1.0         0.1         354.04         0.1         352.64         4.0         0.1         352.64         4.0         0.1         352.00         0.4         352.64         8.73         187.52         -0.194         8.1         0.1         352.64	2.4	2509	5.3	130.57	130.37	1	200.00	-0.115		0.1	355.41	-0.01709
3.20         11968         1857         130.57         130.47         8.87         195.46         -0.111         2.5         0.1         354.84           3.40         11689         1746         130.57         130.47         8.89         193.41         -0.092         0.4         0.1         354.84           4.20         11120         1546         130.57         130.47         8.89         193.41         -0.092         0.4         0.1         354.84           4.20         11120         1559         130.47         8.82         187.08         -0.194         8.1         0.1         352.04           5.0         10532         1437         130.57         130.47         8.62         177.81         -0.104         8.1         352.05           5.0         1054         1417         130.57         130.47         8.61         166.36         -0.106         8.0         1350.57         350.79           6.0         9674         1417         130.57         130.47         8.61         166.36         -0.106         8.0         1350.57         1350.79           6.0         9674         1446         130.57         130.47         8.61         145.30         0.1	8	2241		130.57	130.37		197.71	-0.113		0:1	355.46	-0.01758
3.40         11689         1746         130.57         130.47         8.89         193.41         -0.092         0.4         0.1         354.04           4.0         11406         1646         130.57         130.37         8.87         191.05         -0.153         8.1         0.1         353.63           4.0         11806         1559         130.57         130.47         8.73         187.52         -0.154         8.1         0.1         352.04           5.0         10543         1497         130.57         130.37         8.62         177.61         -0.305         16.7         0.1         350.75           5.0         10544         1400         130.57         130.37         8.61         162.42         -0.248         130.75         0.1         350.75           6.0         9654         1415         130.57         130.47         8.61         162.42         -0.206         8.7         0.1         350.75           6.0         9654         1446         130.57         130.47         8.61         162.42         -0.206         8.7         0.1         350.75           6.0         9654         1446         130.57         130.47         8.51         14	3.2	1968	11 7	130.57	130.47		195,46	-0.111	•	0.1	354.86	-0.01758
4. 0         11406.         1646.         130.57         130.37         8.87         191.05         -6.153         8.1         0.1         353.64           4.20         11120.         1559.         130.47         8.82         187.52         -0.194         8.1         0.1         352.64           4.20         11120.         1559.         130.47         130.47         8.82         187.52         -0.194         8.1         0.1         352.64           5.0         10543.         1470.         130.57         130.47         8.58         172.81         -0.181         0.1         352.05           5.0         1054.         1440.         130.57         130.47         8.61         166.36         -0.166         6.0         0.1         351.68           6.0         9674.         1446.         130.57         130.47         8.58         152.74         -0.166         8.7         0.1         351.68           6.0         9674.         1446.         130.57         130.47         8.56         148.14         -0.166         8.7         0.1         351.67           6.40         9098.         1446.         130.57         130.47         8.56         148.14         -0.16 <th>3.4</th> <th>14</th> <th>•</th> <th>130.57</th> <th>130.47</th> <th></th> <th>193,41</th> <th>-0.092</th> <th></th> <th>0.1</th> <th>354.04</th> <th>-0.01758</th>	3.4	14	•	130.57	130.47		193,41	-0.092		0.1	354.04	-0.01758
4.20         11120.         1559.         130.47         130.47         8.82         197.52         -0.194         8.1         0.1         352.64           4.40         10832.         1488.         130.57         130.47         8.73         183.08         -0.248         12.1         0.1         352.00           5.0         10543.         1430.         130.57         130.47         8.62         17.81         -0.181         0.1         352.00           5.0         9674.         1405.         130.57         130.47         8.61         166.30         -0.186         6.0         0.1         351.63           6.0         9674.         1405.         130.57         130.47         8.61         166.30         -0.166         6.0         0.1         351.63           6.0         9674.         1415.         130.57         130.47         8.61         166.30         -0.106         0.0         0.1         351.63           6.0         9674.         1416.         130.57         130.47         8.56         148.14         -0.126         0.1         351.64           6.40         9677.         1878.         130.47         8.56         148.14         -0.126         0.1	. 4.	1406	•	130.57	130.37		191.05	-0.153	ì •	0.1	353.63	-0.01758
4.40         10832.         130.57         130.47         8.73         183.08         -0.248         12.1         0.1         352.00           5.0         10543.         1437.         130.57         130.37         8.62         177.61         -0.305         16.7         0.2         350.73           5.0         10254.         1440.         130.57         130.37         8.62         177.61         -0.181         0.7         0.1         350.75           6.0         9674.         1447.         130.57         130.47         8.61         165.30         -0.166         8.7         0.1         350.67           6.0         9674.         1447.         130.57         130.47         8.61         165.30         -0.249         12.1         0.1         350.77           6.20         9385.         1446.         130.57         130.47         8.56         148.14         -0.126         8.7         0.1         350.7           7.0         8817.         1560.         130.47         8.56         148.14         -0.126         8.7         0.1         350.7           7.0         8817.         150.57         130.47         8.51         143.19         -0.19         0.1	. 4.2	1120	14 1	130.47	130.47		187.52	-0.194	•	0.1	352.64	-0.01709
5. 0         10543.         1437.         130.37         130.37         8.62         177.61         -0.305         16.7         0.2         350.55           5.20         10254.         1410.         130.47         8.58         172.81         -0.181         0.7         0.1         350.55           5.40         9964.         1405.         130.57         130.47         8.60         169.64         -0.166         6.0         0.1         351.68           6.0         9954.         1405.         130.57         130.47         8.61         166.30         -0.264         8.7         0.1         351.68           6.40         9988.         14946.         130.57         130.47         8.61         157.86         -0.249         12.1         0.1         350.79           6.40         9988.         130.57         130.47         8.56         165.27         0.249         12.1         0.1         350.49           7.0         8517.         1560.         130.47         8.55         145.30         -0.14         0.5         0.1         350.45           8.0         8007.         1878.         130.47         8.83         141.64         0.03         0.1         351.63	4.4	8	11.	130.57	130.47	Ü	183.08	-0.248	•	0.1	352.00	-0.01709
5.20         10254.         1410.         130.47         130.37         8.58         172.81         -0.181         0.7         0.1         350.55           5.40         9964.         1405.         130.57         130.47         8.60         169.64         -0.160         6.0         0.1         351.68           6.0         9674.         1417.         130.57         130.47         8.61         166.30         -0.160         6.0         0.1         351.68           6.20         9385.         1446.         130.57         130.47         8.61         166.30         -0.206         8.7         0.1         350.79           6.40         9988.         1446.         130.57         130.47         8.58         157.84         -0.249         12.1         0.1         350.79           7.0         8517.         156.0         130.47         8.62         145.30         -0.156         12.2         0.1         351.83           8.0         8007.         1878.         130.47         8.62         145.30         -0.156         0.5         0.1         351.83           8.0         744.         2016.         130.57         130.47         8.93         141.54         0.09	'n	0543	-	130.57	130.37	•	177.61	-0.305	•	0.2	350.73	-0.01709
6.0         9964.         1405.         130.57         130.47         8.60         166.30         -0.160         6.0         0.1         351.68           6.0         9674.         1417.         130.57         130.47         8.61         166.30         -0.176         8.7         0.1         351.83           6.20         9385.         1446.         130.57         130.47         8.61         165.42         -0.26         8.7         0.1         350.79           6.40         9098.         1494.         130.57         130.47         8.58         152.74         -0.249         12.1         0.1         350.79           7.0         8517.         1560.         130.57         130.47         8.56         148.14         -0.176         0.5         0.1         350.49           7.0         8517.         156.7         130.47         8.56         145.30         -0.176         0.5         0.1         350.45           8.0         8007.         137.8         130.47         8.83         141.54         -0.176         0.5         0.1         350.45           8.0         744.         2016.         130.57         130.47         8.99         141.54         0.037	5.2	0254	-	130.47	130,37	•	172.81	-0.181	•	0.1	350.55	-0.01709
6. 0         9674.         1417.         130.57         130.47         8.61         166.30         -0.176         8.7         0.1         351.83           6.20         9385.         1446.         130.57         130.27         8.60         162.42         -0.206         8.7         0.1         350.96           6.40         9098.         1494.         130.57         130.47         8.58         157.86         -0.249         12.1         0.1         350.79           7.0         8817.         1560.         130.57         130.47         8.56         148.14         -0.156         0.2         0.1         350.49           7.0         8817.         143.19         -0.076         0.5         0.1         350.47         8.50.43           9.0         8007.         1878.         130.47         130.47         8.83         141.54         0.079         0.5         0.1         351.67           8.0         744.         2016.         130.57         130.47         9.36         141.54         0.037         9.7         0.1         351.67           9.0         740.         6688.         2667.         130.57         130.47         9.52         148.79         0.152	5.4	8	<b>D</b>	130.57	130.47	•	169.64	-0.160	•	0.1	351.68	-0.01709
6.20         9385.         1446.         130.57         130.27         8.60         162.42         -0.206         8.7         0.1         350.96           6.40         9098.         1494.         130.57         130.47         8.58         157.86         -0.249         12.1         0.1         350.79           7.0         8817.         1560.         130.57         130.47         8.56         148.14         -0.760         12.2         0.1         351.04           7.0         8852.         130.47         8.56         148.14         -0.176         0.5         0.1         350.49           7.0         8272.         1755.         130.57         130.47         8.56         145.30         -0.119         0.5         0.1         351.67           8.0         8007.         1878.         130.47         130.47         8.99         141.54         -0.042         -5.7         0.1         351.67           8.0         740.         6485.         2667.         130.57         130.47         9.52         148.79         0.152         9.7         0.1         358.2           9.40         6688.         2667.         130.57         130.47         9.52         148.73	•	74	_	130.57	130.47	•	166.30	-0.176	· •	0:1	351.83	-0.01709
6.40         9098         1494         130.57         130.47         8.58         157.86         -0.249         12.1         0.1         350.79           7.0         8817         1560         130.57         130.47         8.56         148.14         -0.260         12.2         0.1         351.04           7.20         8542         1548         130.57         130.47         8.56         145.30         -0.176         0.5         0.1         350.49           7.40         8272         1755         130.47         130.47         8.54         145.30         -0.119         0.5         0.1         350.45           8.0         8007         1878         130.47         130.47         8.94         141.54         -0.089         0.5         0.1         351.67           8.40         7485         2331         130.57         130.47         8.94         141.54         -0.08         0.5         0.1         351.67           8.40         7485         2331         130.57         130.47         9.36         143.08         0.1037         9.7         0.1         351.67           9.40         6688         2667         130.57         130.47         9.56         152.4	6.2	B	•	130.57	130.27	•	162,42	-0.206		0.1	350.96	-0.01709
7. 0         8817.         1560.         130.57         130.47         8.55         152.74         -0.260         12.2         0.1         351.04         -0.5           7.20         8542.         1648.         130.57         130.47         8.56         148.14         -0.176         0.5         0.1         350.49         -0.5           7.40         8272.         1755.         130.57         130.47         130.47         8.51         143.19         -0.079         0.5         0.1         352.57         -0.           8.20         7744.         2016.         130.57         130.47         8.99         141.54         -0.072         -5.7         0.1         351.67         -0.           8.40         7485.         2351.         130.57         130.47         9.18         143.08         0.108         -9.7         0.1         354.48         -0.           9.40         6888.         2667.         130.57         130.47         9.55         148.79         0.152         -2.0         0.1         356.43         -0.           9.40         6888.         2667.         130.57         130.47         9.55         148.79         0.189         -2.0         0.1         0.1	6.4	86		130.57	130.47	•	157.86	-0.249	•	0.1	350.79	-0.01709
7.20         8542.         1648.         130.57         130.47         8.56         148.14         -0.176         0.5         0.1         350.49         -0.176         0.5         0.1         352.57         -0.176         0.5         0.1         352.57         -0.187         -0.187         130.47<	. 7.	17	V:	130.57	130.47	•	152.74	-0.250	•	0.1	351.04	-0.01709
7.40         8272.         130.57         130.47         8.62         145.30         -0.119         0.5         0.1         352.57         -0.099           8.0         8007.         1878.         130.47         130.37         8.71         143.19         -0.099         0.5         0.1         351.83         -0.           8.20         7744.         2016.         130.57         130.47         8.93         141.54         -0.097         0.5         0.1         351.87         -0.           9.0         7485.         2168.         130.57         130.47         9.18         143.08         0.108         -9.7         0.1         354.48         -0.           9.0         6688.         2647.         130.57         130.47         9.52         148.79         0.152         -2.0         0.1         356.43         -0.           9.40         6688.         2647.         130.57         130.47         9.56         150.88         0.088         -2.0         0.1         0.1         0.2         0.1         0.1         0.2         0.0         1.0         0.0         0.1         0.1         0.2         0.1         0.1         0.2         0.1         350.0         0.1 <th< th=""><th>. 7.2</th><th>Ç.</th><th>~</th><th>130.57</th><th>130.47</th><th>•</th><th>148.14</th><th>•</th><th>•</th><th>0.1</th><th>&lt;</th><th>-0.01709</th></th<>	. 7.2	Ç.	~	130.57	130.47	•	148.14	•	•	0.1	<	-0.01709
8. 0         8007.         1878.         130.47         130.37         8.71         143.19         -0.099         0.5         0.1         351.83         -0.           8.20         7744.         2016.         130.57         130.47         8.99         141.62         -0.042         -5.7         0.1         351.67         -0.           8.40         7485.         2168.         130.57         130.47         8.99         141.54         0.037         -9.7         0.1         354.48         -0.           9.0         7224.         2331.         130.57         130.37         9.18         143.08         0.108         -9.7         0.1         356.43         -0.           9.0         6688.         2667.         130.57         130.47         9.52         148.79         0.129         -2.0         0.1         358.82         -0.           10.0         6409.         2831.         130.57         130.47         9.6         152.41         0.069         -2.0         0.1         1.10         -0.           10.2         6124.         2993.         130.47         9.6         152.41         0.069         -2.0         0.1         1.10         -0.0         1.29         -0.0 </th <th>7.4</th> <th></th> <th></th> <th>130.57</th> <th>130.47</th> <th>•</th> <th>145.30</th> <th>-0.119</th> <th>•</th> <th>0</th> <th>352,57</th> <th>17</th>	7.4			130.57	130.47	•	145.30	-0.119	•	0	352,57	17
8.20         7744.         2016.         130.57         130.47         8.83         141.62         -0.042         -5.7         0.1         351.67         -0.0           8.40         7485.         2168.         130.57         130.47         8.99         141.54         0.037         -9.7         0.1         354.68         -0.           9.0         7224.         2331.         130.57         130.37         9.18         143.08         0.108         -9.7         0.1         356.43         -0.           9.20         6960.         2499.         130.57         130.47         9.52         148.79         0.129         -2.0         0.1         358.82         -0.           9.40         6688.         2667.         130.57         130.47         9.6         150.88         0.088         -2.0         0.1         0.2         0.0         <		0	1	130.47	130.37	٠	143.19	•	•	0.1	œ	-0.01709
8.40       7485.       2168.       130.57       130.47       8.99       141.54       0.037       -9.7       0.1       354.68       -0.         9.0       7224.       2331.       130.57       130.37       9.18       143.08       0.108       -9.7       0.1       356.43       -0.         9.20       6960.       2499.       130.57       130.47       9.52       148.79       0.152       -9.7       0.1       358.82       -0.         9.40       6688.       2667.       130.57       130.47       9.52       148.79       0.129       -2.0       0.1       0.28       -0.         10.20       6124.       2993.       130.57       130.47       9.77       152.41       0.069       -2.0       0.1       1.10       -0.         10.40       5833.       3153.       130.47       130.37       9.86       153.70       0.061       -1.9       0.1       1.29       -0.	8.2	4		130.57	130.47	•	141.62	•	•	0.1	4	-0.01709
9. 0         7224.         2331.         130.57         130.37         9.18         143.08         0.108         -9.7         0.1         356.43         -0.           9.20         6960.         2499.         130.57         130.37         9.52         148.79         0.152         -9.7         0.1         358.82         -0.           9.40         6688.         2667.         130.57         130.47         9.52         148.79         0.129         -2.0         0.1         0.2	8.4	œ	v€.	130.57	130.47	•	141.54	•	•	0.1	54.6	-0.01709
. 9.20 6960. 2499. 130.57 130.37 9.36 145.73 0.152 -9.7 0.1 358.82 -0. 9.40 6688. 2667. 130.57 130.47 9.52 148.79 0.129 -2.0 0.1 0.28 -0. 10.0 6409. 2831. 130.57 130.47 9.66 150.88 0.088 -2.0 0.1 0.80 -0. 10.20 6124. 2993. 130.57 130.47 9.77 152.41 0.069 -2.0 0.1 1.10 -0. 10.40 5833. 3153. 130.47 130.37 9.86 153.70 0.061 -1.9 0.1 1.29 -0.	· •	C4	2	130.57	130.37	7	143.08	ᅼ	٠	0.1	56.4	-0.01709
. 9.40 6688, 2667, 130.57 130.47 9.52 148.79 0.129 -2.0 0.1 0.28 -0.0 10.0 6409. 2831, 130.57 130.47 9.66 150.88 0.088 -2.0 0.1 0.80 -0.0 10.20 6124, 2993, 130.57 130.47 9.77 152.41 0.069 -2.0 0.1 1.10 -0.0 10.40 5833, 3153, 130.47 130.37 9.86 153.70 0.061 -1.9 0.1 1.29 -0.0	. 9.2	÷	0	130.57	٠	77	•	7	•	0.1	59.8	
.10. 0 6409. 2831. 130.57 130.47 9.66 150.88 0.088 -2.0 0.1 0.80 -0.0 .10.20 6124. 2993. 130.57 130.47 9.77 152.41 0.069 -2.0 0.1 1.10 -0.0 .10.40 5833. 3153. 130.47 130.37 9.86 153.70 0.061 -1.9 0.1 1.29 -0.0	9.4	œ	•	130.57	•	•	•	7	•	0.1	CI	•
•10•20 6124• 2993• 130•57 130•47 9•77 152•41 0·069 -2·0 0·1 1·10 -0·0 •10•40 5833• 3153• 130•47 130•37 9·86 153·70 0·061 -1·9 0·1 1·29 -0·0	.10.	0	2831.	130.57	•	•	150.88	•		0.1	œ	-0.01709
•10•40 5833 3153 130•47 130.37 9.86 153.70 0.061 -1.9 0.1 1.29 -0.	.10.2	124	2993.	130.57	•	•	152,41	•	•	0.1	-	-0.01709
	.10.4	83	3153.	130.47	•	•	153.70	ó	•	0.1		•

FIGURE 9 - PRINTER OUTPUT



opy available to DTIC does not ppy available reproduction FIGURE 10 - BERWICK BAY, LOUISIANA CHART smit fully 1 gible reproduction FIGURE 10 - BERWICK BAY, LOUISIANA CHART

### Downstream Operation

- Entering Berwick Bay from the Port Allen route hold the sailing line shown and reduce speed to about half ahead.
- Entering Berwick Bay from Stouts Pass cross the river between (5) and (6) and favor left descending shore.
- Generally hold slow speed between 4 and 3 with intermittent use of power to stay on course and close to shore.
- At(3)current will set tow toward right descending shore if out too far in river.
- Cut point at Conrad Shipyard 3 in close to prevent current from catching stern of tow and rotating it out toward mid-river.
- Run between slow and half speed at 3 to maintain steerage and control.
- Should be shaped up by 2. Current tends to get tow out-of-shape between (2) and (3).
- At 1 either drive or hold half speed depending on conditions.
- Enter highway bridge at mid span or just to the right of mid span depending on current conditions.
- Current will shift at highway bridge and operator must expect a strong left hand draft between bridges.
- Favor right descending pier of railroad bridge to offset current and to prepare for sharp right hand bend in river just below bridge.
- Under some conditions with a long tow you must back and flank as soon as you clear the railroad bridge in order to line up for the passage down river.

### Upriver

- In general operator can hold middle of river during upstream approach.
- At②slow down and line up with railroad bridge.
- Favor Berwick pier (left ascending pier) to offset current just below and between bridges.

FIGURE 11 - OPERATOR STRATEGEY

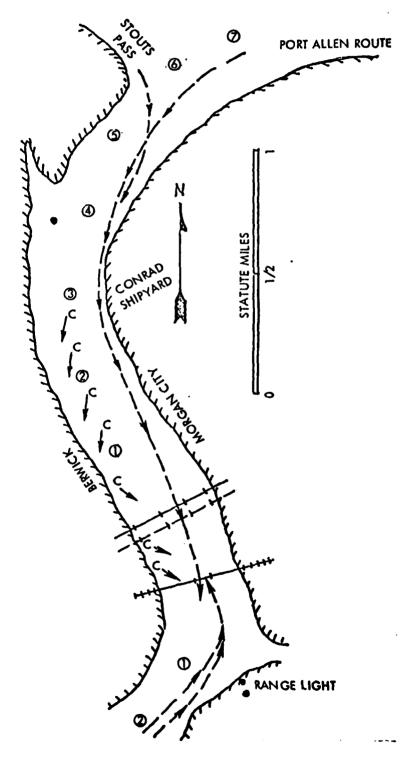


FIGURE 12 - BERWICK BAY PASSAGE



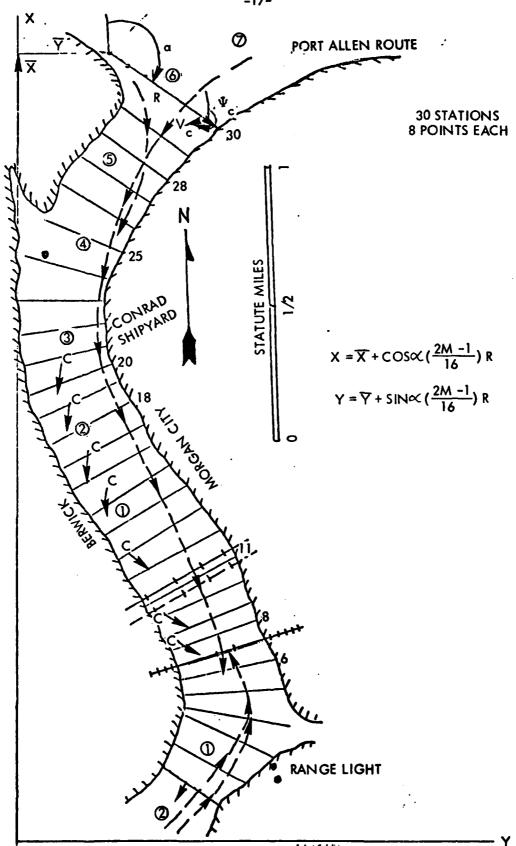
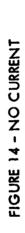
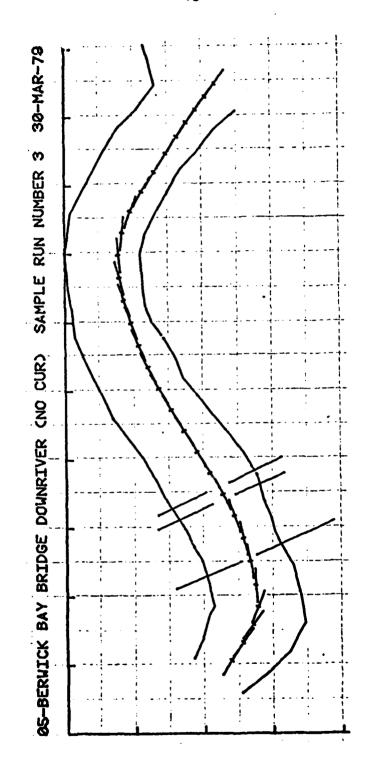


FIGURE 13 - CURRENT MAP





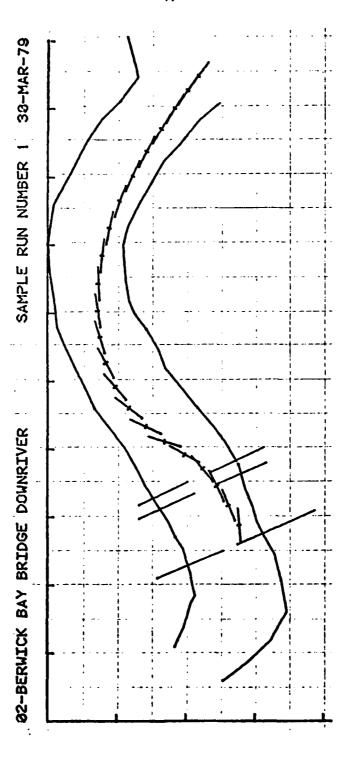


FIGURE 15 - ÉFFECTS OF UPSTREAM AND BRIDGE CURRENTS

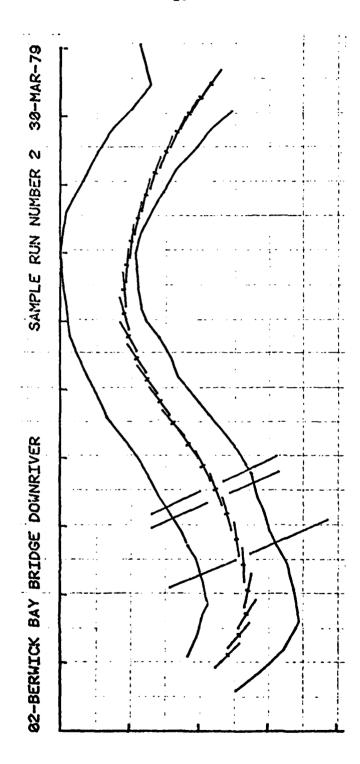


FIGURE 16 - EFFECTS OF UPSTREAM AND BRIDGE CURRENTS

5.0 CONSOLE CONNECTIONS

### HYDRONAUTICS, Incorporated

-22-

### A/D DEFINITIONS

0 - 15 Channels  $\pm 5V$ 

- 1 WIRE A Port Propeller RPM
- 2 WIRE E Starboard Propeller RPM
- 3 WIRE B Steering Rudders
- 5 WIRE C Flanking Rudders
- 7 WIRE D Thruster RPM
- 8 WIRE F Stop Switch

### D/A DEFINITIONS

0 - 7 Channels ±5V

0 - WIRE J - Port Propeller RPM

1 - WIRE K - Starboard Propeller RPM

2 - WIRE L - Steering Rudder Angle

3 - WIRE M - Flanking Rudder Angle

4 - WIRE N - Thruster RPM

5 - WIRE P - Rate of Turn

6 - WIRE R - Heading

7 - WIRE S -

### HYDRONAUTICS, Incorporated

-24-

6.0 SIMULATOR OPERATION

### RUNNING THE SIMULATOR

### TURN ON

DEC PDP 11/34

DEC WRITER (300 BAUD, LINE, AUTO LF)

PLOTTER (LOAD)

4014 TERMINAL (RESET PAGE ON GLOW)

CONSOLE - SERVO RESET ON, RUN ON

TURN ON DISK 0

### COLD START

CTRL/HLT, CTRL/BOOT TYPE:DL)
@ STARTG)

### **SCREEN**

TYPE: DATE — 10-May-79 TIME — 20:30:15 RUN — MAT10

### FOLLOW INSTRUCTIONS

ENTER OPERATOR I.D. UP TO 20 CHARACTERS

MOVE DEC WRITER TO NEW PAGE

LOAD PLOTTER, REMOVE COVER AND SET PEN (780 x 1170 GRID)

CONSOLE SERVO OFF, RUN ON

RESET SCREEN

ON 4014

### STOPPING

RUN OFF ON CONSOLE (STOP ON SCREEN)
TURN RUN ON AGAIN

### CHANGING THE PROBLEM

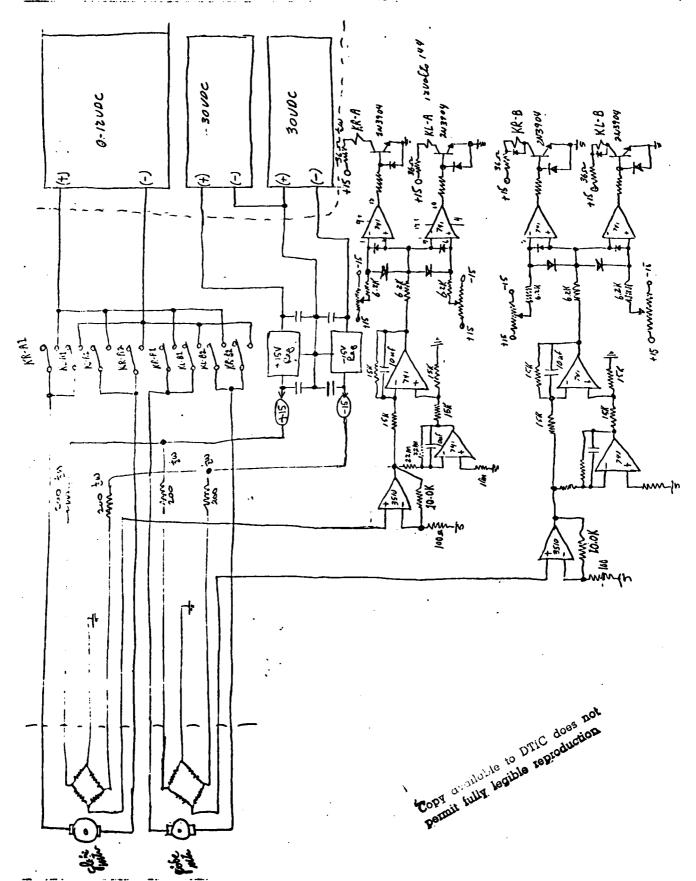
COPY — DTSXX.FOR — DTN10.FOR (XX = PROBLEM NUMBER))
FORTRAN — DTN10)
@ MAT10)

### TURNING OFF

DISK 0 OFF (LOAD)
PLOTTER LOAD, PEN COVER ON
SERVO ON, RUN ON, CONSOLE OFF (AFTER HEADING = 0)
TEKTRONIX 4014 OFF
PLOTTER OFF
DEC WRITER OFF
DEC 11/34 OFF

-27-

7.0 WIRING DIAGRAMS



### 8.0 SCENARIO PARAMETERS

Many of the variables in the input routines which are used to establish the operating geometry are described here in detail. Subroutine DTL10 - Initial Conditions

XS, YS - Initial towboat position. XS is the horizontal co-ordinate in scene units, positive to the right, which is also the North direction of the scene. YS is the vertical co-ordinate in scene units, positive downward, which is the East direction.

PSID - Initial towboat orientation, with 0 being the North direction (headed to the right), 90 being East (headed down), etc.

NCCS - Number of current (and also scene) station to check first in current determination subroutine. Usually 1 or NCCT if boat starts at either end of the scene.

Subroutine DTM10 - Towboat Parameters

No scene parameters

Subroutine DTN10 - Scene Parameters

NCCT - Number of current/scene stations

SCALF - Scale factor used to allow current and scene parameters to be entered in other than scene units. The values of XX, YY, and RR used to set the scene are multiplied by SCALF in Subroutine SUB11 to change them to scene units for storage in the XW and YW arrays.

XX - Horizontal co-ordinate of a station starting point. Positive to the right. Units compatible with scene using SCALF.

YY - Veritcal co-ordinate of a station starting point.
Positive downward. Units compatible with scene using SCALF.

- RR Radial co-ordinate of station. The scene boundary is at the ends of the RR line. One end is at XX, YY, and other at the end of RR. Units compatible with scene using SCALF.
- PP Orientation of RR with respect to XX, YY point, in degrees. PP equal to 270 implies that RR is in an upward vertical direction, so that the scene boundary is at XX, YY and XX, YY-RR. The end points of the NCCT stations are connected to form the scene boundary.
  - VC, PSIC Current values in ft/sec and direction in degrees.

    VC(1) to VC(8) are the eight values at Station 1

    VC(9) to CV (16) at Station 2, etc.
- NPPB Number of straight line segments (up to 10) drawn on scene. Co-ordinates are in scene units; SCALF is not used to change them. XB(1), YB(1) is the starting point of line 1, XB(2), YB(2) is the end of this line.
- NPPT Number of positions plotted on graphic output device for every 1 plot of towboat position on plotter.
- NCCS If NCCS is set to -2, no current is assumed by the current subroutine CURT. This saves time by not requiring CURT to search for the current values at each calculation interval.

## DATE ILME